CISC HANDBOOK OF STEEL CONSTRUCTION

10th Edition, 1st Printing 2010

REVISIONS LIST NO. 1 - MAY 2011

The following revisions and updates have been incorporated into the 2nd Printing (2011) of the 10th Edition of the CISC Handbook of Steel Construction. Minor editorial corrections are not shown.

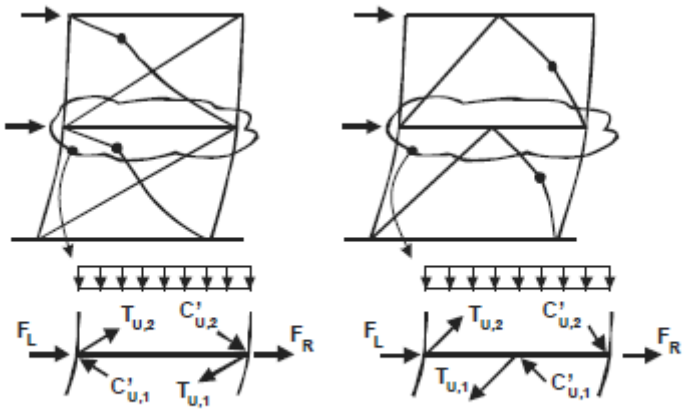
Page	Revisions
1-a	Replace the first paragraph with: "This Standard is reprinted with the permission of the Canadian Standards Association and contains all errata and revisions approved at time of printing. The reprint includes CSA S16-09 "Design of Steel Structures" (September 2009) along with Update No. 1 (October 2010)."
1-xvi	In the paragraph starting with "This Standard was prepared ...", delete the last sentence: "It will be submitted to the Standards Council of Canada for approval as a National Standard of Canada."
2-1	Replace the second paragraph with: "CSA Standard S16-09 has been prepared by the Canadian Standards Association (CSA), an approved standards development organization of the Standards Council of Canada, according to the rules for development of consensus standards. The National Building Code of Canada 2010 has adopted CSA Standard S16-09 by reference."
2-33	Replace the last paragraph with: "For structures analyzed plastically, high shears and moments may occur simultaneously at a hinge location. Yang and Beedle (1951) have shown that, when the maximum shear stress is limited to the von Mises value, the flexural resistance can be maintained at M_p. Taking the effective section depth as 95% of the nominal depth, this Clause gives an approximate shear resistance limited to the von Mises stress. (See Commentary to Clause 8.3.2(d))."
2-48	In the first paragraph under the heading, "13.11 Block Shear - Tension Member, Beam, and Plate Connections", replace "The new equation ... block of material." with: "The equation introduced in S16-09 uses a shear stress equal to the average of the yield and rupture shear strength, $0.6[(F_y + F_u)/2]$, on the gross shear area, A_{gv}. This term also gives the bolt end tear-out capacity (Cai and Driver, 2010). The tension component consists of $U_t A_n F_u$ where U_t accounts for the uniformity of the stress distribution on the tension face of the block of material."

2-92 In Figure 2-56, top right, replace "TWO ROLLED SHAPES NOT IN CONTACT" with "TWO ROLLED SHAPES IN CONTACT"

2-111 In the second paragraph, replace the last sentence "In addition … foundation rocking" with: "Also, where foundation rocking is accounted for in accordance with NBCC, design forces for the SFRS may be limited to values associated with maximum forces that can develop with foundation rocking (always larger than forces at $R_d R_o = 2$)."

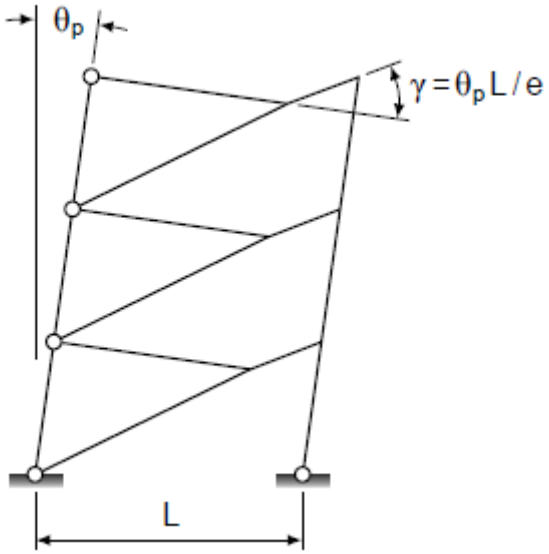
2-116 At the bottom of the page, replace "Reference to this material is given in Annex J" with: "Reference to this material includes CISC (2009), Ricles et al. (2004) and the references given in Annex J."

2-123 Replace Figure 2-66(a) with the following:



(a) Beams in X-Bracing and Chevron Bracing

2-128 Replace Figure 2-67 (bottom right) with the following:



2-132 Under the heading "27.7.8 Link Beam-to-Column Connection", replace the first paragraph with:
"Links are often connected directly to the column face in order to accommodate doorways adjacent to columns. This configuration causes severe straining of the link, connection welds and column flanges as the link deforms. Tests by Okazaki et al. (2006) on link-to-column connections designed and fabricated using pre-Northridge practices showed poor performance. Test specimens with improved welding details alone did not develop the level of inelastic rotation intended in design. Until joint details that can exhibit satisfactory inelastic behaviour are developed, link connections must be demonstrated to meet the performance criteria defined in this clause. As for moment-resisting frames, this demonstration can be provided by cyclic tests of full-scale prototypes of the link and column assemblage, following the procedures given in AISC (2005)."

Under the same heading, add a third paragraph:
"Link beam-to-column connections can be avoided by adopting a chevron bracing configuration, thereby locating the links away from the columns."

2-140 In the first paragraph, replace "bending moment $M_f = P_f R/2$" with "bending moment $M_f = P_f e$".

Replace the equation below the first paragraph with the following:

$$P_f = \frac{15EI_y}{16e^2}\frac{\Delta}{h_s}$$

2-149 Add the following reference:
"Cai, Q. and Driver, R.G. 2010. Prediction of bolted connection capacity for block shear failures along atypical paths. Engineering Journal, American Institute of Steel Construction, vol. 47, 4th Quarter."

2-150 Add the following reference:
"CISC. 2009. Moment Connections for Seismic Applications. Canadian Institute of Steel Construction, Markham, Ontario."

2-158 Add the following reference:
"Okazaki,T., Engelhardt, M.D., Nakashima, M., and Suita, K. 2006. Experimental performance of link-to-column connections in eccentrically braced frames. Journal of Structural Engineering, ASCE, 132, 8, 1201–1211."

2-159 Add the following reference:
"Ricles, J.M., Zhang, X., Lu, L.-W. and Fisher, J. 2004. Development of seismic guidelines for deep-column steel moment connections. ATLSS Report No. 04-13, Lehigh University, Bethlehem, PA."

3-3 In the first paragraph, replace the clause reference, "13.12.1.1(a)" with "13.12.1.2(a)".

3-5 Under the heading "Bolts in Bearing-Type Connections", replace "Clauses 13.12.1.1(a) and 13.12.1" with "Clause 13.12.1".

3-7 In the second paragraph, replace "Clause 13.12.1.1" with "Clause 13.12.1.2", and replace "Clause 13.12.1.2" with "Clause 13.12.1.3".

In the paragraph immediately above Table 3-2, replace "Clause 13.12.1.3" with "Clause 13.12.1.4".

In Table 3-2, replace the clause reference, "13.12.1.1" with "13.12.1.2", replace "13.12.1.1(c)" (both occurrences) with "13.12.1.2(c)", replace "13.12.1.1(a)" with "13.12.1.2(a)", and replace "13.12.1.2" with "13.12.1.3".

3-8 In the footnote below Table 3-4, replace "Clause 13.12.1.1" with "Clause 13.12.1.2".

3-9 to 3-11 In the footnote at the bottom of the page, replace "Clause 13.12.1.1(b)" with "Clause 13.12.1.2(b)".

3-12 In the first paragraph, replace "Clause 13.12.1.3" with "Clause 13.12.1.4".

3-19 In the first paragraph, replace "Clause 13.12.1.2" with "Clause 13.12.1.3".

3-21 In the last paragraph, replace "Clause 13.12.1.2" with "Clause 13.12.1.3".

3-28 In the paragraph near the middle of the page starting with "The connected material...", replace "Clause 13.12.1.1" with "Clause 13.12.1.2".

In examples 1 and 2, change Metric bolt sizes to Imperial sizes.

3-36 In the last paragraph, replace "13.12.1.3" with "13.12.1.4".

3-41 In Table 3-24, add the heading, "Matching Electrode Applications".

In Table 3-25, delete the heading "F_u = 450 MPa".
Replace the bottom footnote with "When over-matched electrodes are used, the base metal capacity should also be checked (S16-09 Clause 13.13.2.2)." Replace the factored shear resistances with values shown in shaded areas on the attached Table 3-25.

3-44 Replace coefficients C with the values shown in shaded areas on the attached Table 3-26.
Replace the footnote with "When over-matched electrodes are used, the base metal capacity should also be checked (S16-09 Clause 13.13.2.2)."

3-45 Replace the footnote with "When over-matched electrodes are used, the base metal capacity should also be checked (S16-09 Clause 13.13.2.2)."

3-46 to 3-51 Replace coefficients C with the values shown in shaded areas on the attached Tables 3-28 to 3-33.
Replace the footnote with "When over-matched electrodes are used, the base metal capacity should also be checked (S16-09 Clause 13.13.2.2)."

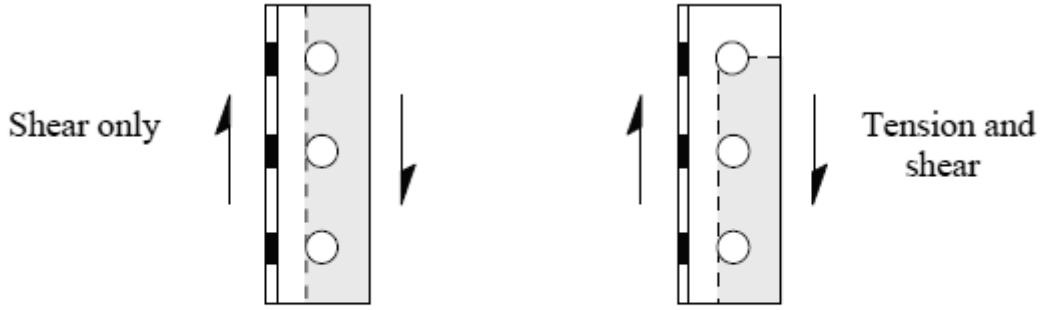
3-53 In the paragraph below Figure 3-3, replace "Kwan and Grondin (2008)" with "Kwan et al. (2010)".

3-54 Near the bottom of the page, replace the second reference with the following:
"KWAN, Y.K., GOMEZ, I.R., GRONDIN, G.Y. and KANVINDE, A.M. 2010. Strength of welded joints under combined shear and out-of-plane bending. Canadian Journal of Civil Engineering, 37(2): 250-261."

3-56 In the third paragraph, replace "Clause 13.12.1.1" with "Clause 13.12.1.2".

3-57 Replace the first paragraph with the following:
"For welded connections, for each weld size the weld shear resistance was equated to the shear resistance of the supported beam web, and the equation solved for the web material thickness t. The weld resistance is based on S16-09 Clause 13.13.2.2, and the web resistance (Clause 13.4.1.1) is $V_r = \phi A_w F_s$, with $F_s = 0.66 F_y$ and A_w = web area."

Replace the figure with the following:

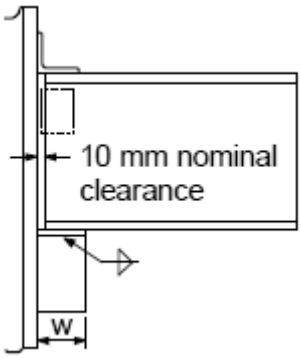


Block Shear Failure
S16-09 Clause 13.11

3-58 In the next-to-last paragraph, replace "Clause 13.12.1.1" with "Clause 13.12.1.2".

3-77 Below Table 3-44, replace "Clause 13.12.1.3" with "Clause 13.12.1.4".

3-79 Replace the figure on the left-hand side of Table 3-45 with the following:



3-101 Under the heading "Bearing resistance at bolt holes", replace "Clause 13.12.1.1(a)" with "Clause 13.12.1.2(a)".

4-5 In the third paragraph (two occurrences) and in the footnote below Table 4-1, replace "C_f/C_y" with "$C_f/\phi C_y$".

4-12 In the second paragraph, replace "WWF shapes with F_y = 300 and 350 MPa" with "WWF shapes with oxy-flame-cut flange plates and F_y = 300 and 350 MPa".

4-17 Replace the first footnote below Table 4-5 with the following: "Calculated in accordance with S16-09 Clause 13.3.1. WWF sections have oxy-flame-cut flange plates."

4-21 In the description of Set 1, replace " WWF shapes conforming to CSA G40.20" with "WWF shapes conforming to CSA G40.20 and with oxy-flame-cut flange plates"

4-24 to 4-30 Add "Oxy-Flame-Cut Flange Plates" to the heading.
Add watermark to the table: "Check WWF Availability. See page 6-29."

4-118 to 4-119 Add watermark to the table: "Check WWF Availability. See page 6-29."

5-26, 5-36, 5-46, 5-56, 5-66 Add watermark to the table: "Check WWF Availability. See page 6-29."

5-86 to 5-93 Add watermark to the table: "Check WWF Availability. See page 6-29."

5-104 to 5-111 Add watermark to the table: "Check WWF Availability. See page 6-29."

5-169 Near the top of the page, replace the definition of Vr' with the following:
"factored shear resistance based on plastic analysis of an unperforated beam
$= 0.8 \phi A_w F_s$ (S16-09 Clause 13.4.2)"
Delete the sentence, "This can be obtained ... by 0.833"

5-175 Under the heading "Solution for Hole 'A':", replace the second line with:
"From page 594, $M_r = 900$ kN·m"
Replace the 3rd through 5th lines with:
"$V_r' = 0.8 \phi A_w F_s = 0.8 \times 0.9 \times (603 \times 10.5) \times 0.66 \times 345 = 1040$ kN"

Under the heading "At centreline of hole", replace the third line with:
"$M_f / M_r = 681 / 900 = 0.757$ and $V_f / V_r' = 56.0 / 1040 = 0.0538$"

Under the heading "Check web stability", replace the first line with:
"$V_f / V_r' = 0.0538 < 0.67$"

5-176 Under the heading "Check for unreinforced hole",
replace the 7th line "$\leq 0.92 - 1.9\ (0.0519) = 0.821$"
with "$\leq 0.92 - 1.9\ (0.0538) = 0.818$",
replace "$M_f / M_r = 0.757 < 0.821$" with "$M_f / M_r = 0.757 < 0.818$",
and replace "$0.0519 < 0.263$" with "$0.0538 < 0.263$".

Under the heading "At centreline of hole",
replace "$V_f / V_r' = 132 / 1080 = 0.122$" with "$V_f / V_r' = 132 / 1040 = 0.127$"

Under the heading "Check web stability"
replace "$V_f / V_r' = 0.122 < 0.67$" with "$V_f / V_r' = 0.127 < 0.67$"

5-177 Under the heading "Check for unreinforced hole",
replace the 5th line "$\leq 0.88 - 3.83\ (0.122) = 0.413$"
with "$\leq 0.88 - 3.83\ (0.127) = 0.394$"
replace "$M_f / M_r = 0.558 > 0.413$" with "$M_f / M_r = 0.558 > 0.394$"

Under the heading "Reinforcement",
replace the 7th line "$\leq 1.013 - 2.53(0.122) = 0.704$"
with "$\leq 1.013 - 2.53(0.127) = 0.692$"
replace "$M_f / M_r = 0.558 < 0.704$" with "$M_f / M_r = 0.558 < 0.692$"

5-179 Under the heading "Check shear",
replace the equation "$= \sqrt{3}\left(\frac{603}{300}\right)\left(\frac{1120}{10.5 \times 603}\right)(1 - 0.58)\,1\,080 = 279$"
with "$= \sqrt{3}\left(\frac{603}{300}\right)\left(\frac{1120}{10.5 \times 603}\right)(1 - 0.58)\,1\,040 = 269$"

replace "$132 < 279$" with "$132 < 269$",
and replace "$V_f / V_r' = 0.122 < 0.42$" with "$V_f / V_r' = 0.127 < 0.42$"

6-29 In the first paragraph, delete the two sentences, "Canadian welded shapes are produced by Essar Steel Algoma Inc. and are available in 350W grade material. If the use of other grades of steel is contemplated, the manufacturer should be consulted."

Under the heading "Availability of WWF and WRF Shapes", replace the first paragraph with the following two paragraphs:

"*Important note: Essar Steel Algoma Inc. had been the prime producer until their production of welded shapes discontinued in late 2010. Accordingly, the availability of WWF and WRF shapes should be checked before specifying these sections.*

WWF beam and column shapes, and WRF shapes are generally not carried in inventory."

6-30 to 6-31 Add watermark to the table: "Check WRF Availability. See page 6-29."

6-32 to 6-37 Add watermark to the table: "Check WWF Availability. See page 6-29."

Page 3-41

Table 3-25

FACTORED SHEAR RESISTANCE OF FILLET WELDS PER MILLIMETRE OF WELD LENGTH, FOR ANGLE θ*

E49XX Electrodes

Weld Size	Angle θ between weld axis and force direction					
	0°	15°	30°	45°	60°	90°
mm	kN/mm					
5	**0.778**	0.829	0.915	1.01	1.09	1.17
6	**0.933**	0.995	1.10	1.21	1.31	1.40
8	**1.24**	1.33	1.46	1.61	1.75	1.87
10	**1.56**	1.66	1.83	2.02	2.18	2.33
12	**1.87**	1.99	2.20	2.42	2.62	2.80
14	**2.18**	2.32	2.56	2.82	3.05	3.27
16	**2.49**	2.65	2.93	3.23	3.49	3.73
18	**2.80**	2.98	3.29	3.63	3.93	4.20
20	**3.11**	3.32	3.66	4.04	4.36	4.67

Weld Size	Angle θ between weld axis and force direction					
	0°	15°	30°	45°	60°	90°
in.	kN/mm					
3/16	**0.741**	0.790	0.872	0.961	1.04	1.11
1/4	**0.988**	1.05	1.16	1.28	1.39	1.48
5/16	**1.23**	1.32	1.45	1.60	1.73	1.85
3/8	**1.48**	1.58	1.74	1.92	2.08	2.22
7/16	**1.73**	1.84	2.03	2.24	2.42	2.59
1/2	**1.98**	2.11	2.32	2.56	2.77	2.96
5/8	**2.47**	2.63	2.91	3.20	3.46	3.70
3/4	**2.96**	3.16	3.49	3.84	4.16	4.44

Only single weld orientations are considered (M_w = 1). For loads on specific weld patterns, see Tables 3-26 to 3-33.

* When over-matched electrodes are used, the base metal capacity should also be checked (S16-09 Clause 13.13.2.2).

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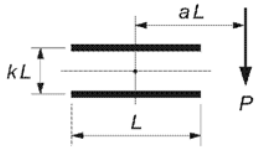
ECCENTRIC LOADS ON WELD GROUPS

Table 3-26

Coefficients C

Electrode: E49XX



P = Factored eccentric load, kN
L = Length of each weld, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below

$P = CDL$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k															
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
0.00	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467	.467
0.05	.395	.400	.410	.422	.432	.440	.446	.451	.454	.456	.457	.460	.461	.462	.462	.463
0.10	.355	.359	.369	.383	.396	.409	.420	.429	.436	.441	.445	.451	.454	.457	.458	.459
0.15	.321	.324	.334	.346	.362	.377	.391	.403	.413	.422	.428	.438	.445	.449	.452	.455
0.20	.290	.294	.303	.315	.330	.346	.362	.376	.389	.400	.409	.423	.433	.440	.445	.448
0.25	.264	.267	.276	.288	.302	.318	.335	.351	.365	.378	.389	.407	.419	.429	.436	.441
0.30	.241	.244	.253	.265	.278	.293	.310	.326	.342	.356	.368	.389	.405	.416	.425	.432
0.35	.221	.224	.232	.243	.256	.271	.287	.304	.320	.334	.349	.371	.389	.403	.414	.423
0.40	.204	.207	.215	.225	.238	.252	.267	.283	.299	.314	.329	.354	.374	.390	.402	.412
0.45	.189	.192	.199	.209	.221	.234	.249	.264	.280	.296	.311	.336	.358	.376	.390	.401
0.50	.175	.178	.185	.195	.206	.219	.232	.247	.263	.278	.293	.321	.343	.362	.378	.390

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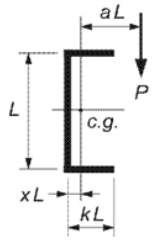
ECCENTRIC LOADS ON WELD GROUPS

Table 3-28

Coefficients C

Electrode: E49XX



P = Factored eccentric load, kN
L = Length of weld parallel to load, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below
xL = Distance from vertical weld to centre of gravity of weld group

$$P = CDL$$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k															
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
0.00	.156	.179	.226	.272	.319	.366	.412	.459	.505	.552	.599	.692	.785	.879	.972	1.065
0.05	.156	.179	.226	.272	.319	.366	.412	.459	.505	.552	.599	.692	.785	.879	.972	1.065
0.10	.156	.179	.226	.272	.319	.366	.412	.459	.505	.552	.599	.692	.785	.877	.967	1.058
0.15	.155	.179	.226	.272	.319	.364	.408	.452	.496	.540	.584	.672	.760	.848	.936	1.025
0.20	.148	.179	.223	.264	.305	.347	.388	.430	.473	.515	.557	.643	.728	.814	.900	.986
0.25	.139	.173	.210	.248	.287	.327	.366	.407	.447	.488	.529	.611	.694	.778	.862	.947

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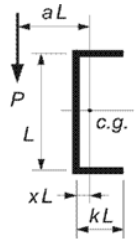
Table 3-29

ECCENTRIC LOADS ON WELD GROUPS

Electrode: E49XX

Coefficients C



P = Factored eccentric load, kN
L = Length of weld parallel to load, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below
xL = Distance from vertical weld to centre of gravity of weld group

$$P = CDL$$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k															
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
0.00	.156	.179	.226	.272	.319	.366	.412	.459	.505	.552	.599	.692	.785	.879	.972	1.065
0.05	.156	.179	.226	.272	.319	.366	.412	.459	.505	.552	.599	.686	.772	.857	.943	1.029
0.10	.156	.179	.226	.272	.319	.366	.412	.454	.496	.537	.579	.663	.746	.829	.912	.996
0.15	.155	.179	.226	.272	.314	.354	.395	.435	.475	.516	.556	.636	.717	.799	.880	.962
0.20	.148	.179	.221	.260	.299	.337	.376	.414	.453	.492	.531	.609	.688	.767	.847	.928
0.25	.139	.173	.209	.245	.282	.319	.355	.393	.430	.468	.505	.581	.658	.736	.815	.894

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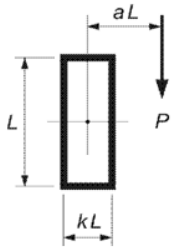
ECCENTRIC LOADS ON WELD GROUPS

Table 3-30

Coefficients C

Electrode: E49XX



P = Factored eccentric load, kN
L = Length of longer welds, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below

Note: When load P is perpendicular to longer side L, use table on facing page.

$$P = CDL$$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k										
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.00	.311	.311	.358	.404	.451	.498	.544	.591	.638	.684	.731
0.05	.311	.311	.358	.404	.451	.498	.544	.591	.638	.684	.731
0.10	.311	.311	.358	.404	.451	.498	.544	.591	.638	.684	.731
0.15	.309	.311	.358	.404	.451	.498	.544	.587	.628	.670	.711
0.20	.296	.311	.358	.403	.441	.480	.519	.559	.599	.639	.680
0.25	.278	.311	.345	.380	.416	.454	.492	.530	.569	.608	.648

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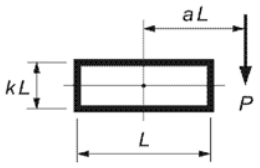
Table 3-31

ECCENTRIC LOADS ON WELD GROUPS

Electrode: E49XX

Coefficients C



P = Factored eccentric load, kN
L = Length of longer welds, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below

Note: When load P is parallel to longer side L, use table on facing page.

$$P = CDL$$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k										
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.00	.467	.493	.519	.546	.572	.599	.625	.652	.678	.705	.731
0.05	.395	.430	.469	.508	.548	.587	.624	.652	.678	.705	.731
0.10	.355	.389	.425	.465	.506	.547	.588	.627	.666	.704	.731
0.15	.321	.353	.389	.427	.467	.509	.550	.591	.632	.672	.711
0.20	.290	.322	.357	.395	.432	.473	.514	.556	.598	.639	.680
0.25	.264	.295	.328	.365	.403	.441	.482	.523	.564	.606	.648

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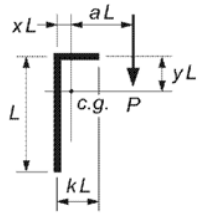
ECCENTRIC LOADS ON WELD GROUPS

Table 3-32

Coefficients C

Electrode: E49XX



P = Factored eccentric load, kN
L = Length of weld parallel to load, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below
xL = Distance from vertical weld to centre of gravity of weld group
yL = Distance from horizontal weld to centre of gravity of weld group

$$P = CDL$$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k															
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
0.00	.156	.156	.179	.202	.226	.249	.272	.296	.319	.342	.366	.412	.459	.505	.552	.599
0.05	.156	.156	.179	.202	.226	.249	.272	.296	.319	.342	.366	.412	.459	.505	.552	.599
0.10	.156	.156	.179	.202	.226	.249	.272	.296	.319	.342	.366	.412	.459	.505	.552	.599
0.15	.155	.156	.179	.202	.226	.249	.272	.296	.319	.341	.362	.406	.449	.493	.538	.582
0.20	.148	.156	.179	.202	.223	.243	.263	.283	.304	.324	.345	.387	.429	.472	.516	.559
0.25	.139	.156	.174	.192	.210	.229	.248	.267	.286	.306	.326	.367	.409	.451	.494	.537

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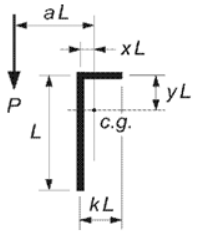
Table 3-33

ECCENTRIC LOADS ON WELD GROUPS

Electrode: E49XX

Coefficients C



P = Factored eccentric load, kN
L = Length of weld parallel to load, mm
D = Size of fillet weld, mm
C = Coefficients tabulated below
xL = Distance from vertical weld to centre of gravity of weld group
yL = Distance from horizontal weld to centre of gravity of weld group

$$P = CDL$$

Required Minimum $C = \frac{P}{DL}$

Required Minimum $D = \frac{P}{CL}$

Required Minimum $L = \frac{P}{CD}$

a	k															
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
0.00	.156	.156	.179	.202	.226	.249	.272	.296	.319	.342	.366	.412	.459	.505	.552	.599
0.05	.156	.156	.179	.202	.226	.249	.272	.296	.319	.342	.366	.404	.441	.479	.518	.557
0.10	.156	.156	.179	.202	.226	.249	.272	.295	.313	.330	.348	.384	.420	.458	.496	.535
0.15	.155	.156	.179	.202	.226	.245	.262	.279	.296	.312	.329	.364	.400	.437	.475	.514
0.20	.148	.156	.179	.198	.214	.230	.246	.261	.277	.294	.310	.344	.380	.417	.455	.494
0.25	.139	.155	.170	.185	.200	.215	.229	.245	.260	.276	.293	.326	.362	.399	.436	.475